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PATENT
Attorney Docket No.: AM524R1/T289
TTC No.: 16301-028900

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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

In re application of:

KATSUYUKI MUSAKA et al.

Application No.: 09/187,551

Filed: November 5, 1998

For: METHOD FOR FORMING A THIN
FILM FOR A SEMICONDUCTOR
DEVICE

Examiner: Marianne Padgett

Art Unit: 1762

APPELLANT'S REPLY BRIEF UNDER 37
CFR § 1.193(b)(1)

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

In response to the Examiner's Answer mailed on October 25, 2002 to the Appeal Brief filed on May 10, 2002, Applicants respectfully request the Board of Patent Appeals and Interferences to consider the following remarks. This reply brief is filed in triplicate, and is believed to be proper pursuant to 37 CFR § 1.193(b)(1).

ARGUMENTS:

As an initial matter, the Examiner places undue focus on the lack of express written explanation in the specification of the change of stress from compressive to tensile in Fig. 13. It is settled that drawings alone may provide a sufficient written description of an invention. *Vas-Cath Inc. v. Mahurkar*, 19 U.S.P.Q.2d 1111 (Fed. Cir. 1991).

The Examiner also emphasizes that the specification does not identify the compressive stress with a negative sign, even though Fig. 13 shows that the stress is negative in the compressive state and is positive in the tensile state. It is common practice to denote a compressive stress by a negative sign and a tensile stress by a positive sign. When a stress is expressly identified as a compressive stress, however, it is redundant to state that "the compressive stress is -2×10^8 dynes/cm²." It is sufficient to provide the magnitude for the compressive stress. If a stress is not expressly identified as a compressive stress, then it would be necessary to use a negative sign to denote a compressive stress: "The stress is -2×10^8 dynes/cm²." The Examiner's confusion of how positive and negative signs are used to denote tensile and compressive stresses is exemplified by her statement on page 8, lines 10-12: "On page 11 of the Brief appellant's alleged [sic] that these are magnitudes that are really negative, . . ." There is no such thing as a negative magnitude for a stress. A stress is represented by a magnitude (i.e., an absolute value) and either a sign (+ or -) or a modifier (tensile or compressive).

Thus, the Examiner's criticism of the present disclosure is misplaced, and her allegation that the disclosure does not support the claim and that the claims do not make sense is without merit.

A. There Is No Recapture of Surrendered Subject Matter

Claims 27-29 and 31-33 stand rejected under 35 U.S.C. § 251 as being an improper recapture of subject matter surrendered in the application for the patent upon which the present reissue is based.

Applicants note that the addition of claims 27-29 and 31-33 does not violate the recapture rule. As discussed in the Appeal Brief, independent claim 27 includes a narrowing limitation not present in the claims deliberately canceled in the application and that the narrowing limitation has a material aspect to it.

The Examiner alleges that there is recapture because the recited stress and the concentration of fluorine are inherently related. MPEP 1412.02 states that "if the narrowing limitation is incidental, mere verbiage, or would be inherent even if not recited (in view of the specification), then the claims should be rejected under 35 U.S.C. 251." In this case, even assuming *arguendo* that the change of the stress in the layer were inherently related to the

fluorine concentration, the formation of a layer at the flow rate selected to produce a tensile stress instead of a compressive stress in the layer would still not be incidental, mere verbiage, or inherent. Rather, the formation of a layer having a tensile stress by selecting an appropriate flow rate of the halogen source has a material aspect to it that was not previously surrendered or deliberately canceled and was not inherent in the previously examined claims.

The Examiner's rejection appears to be predicated on her belief that the arguments concerning the various stresses do not make sense, and that the Declaration of Musaka is contradicted by the specification. The Examiner's position is untenable. As stated in the Declaration of Musaka, ¶ 6, Fig. 13 of the present Patent Application shows a reduction of the magnitude of the stress (which is compressive) of about -1.25×10^9 dyne/cm² at zero C₂F₆ flow, with higher C₂F₆ flow rates, where the stress changes from negative (i.e., compressive) to positive (i.e., tensile) at about 450 sccm C₂F₆ flow rate. There is no contradiction between the specification and the Declaration of Musaka.

Moreover, it is well settled that where a reissue claim does not attempt to protect the surrendered subject matter, it does not violate the recapture rule even though it may not include the substance of amendments that were made to gain allowance. *B.E. Meyers & C. v. United States*, 56 U.S.P.Q.2d 1110, 1116 (Ct. Cl. 2000). "The subject matter protected in the new independent reissue claims dealt only with the lens system; it had nothing to do with any type of pulsing circuitry." *Id.* As a result, the court found no violation of the recapture rule.

This case is analogous to *B.E. Meyers*. Claims 27-29 and 31-33 do not attempt to protect the surrendered subject matter, but are directed to a separately patentable aspect of the invention. More specifically, new independent claim 27 is directed to adding a flow of a halogen source to achieve a desired stress in the layer which is a tensile stress instead of a compressive stress that would otherwise result without the flow of the halogen source. Claim 27 has nothing to do with forming a plasma in the vacuum chamber in a region above the substrate by means of an electrical power source from a reaction gas comprising a mixture of tetraethylorthosilicate and a specific type of fluorine-containing halocarbon gas and subjecting the substrate to the plasma so as to deposit a layer of silicon oxide containing at least about 2.5 atomic percent of fluorine onto the substrate without the formation of voids in the film.

For at least the foregoing reasons, Applicants respectfully submit there is no recapture of subject matter surrendered in the application for the patent upon which the present reissue is based.

B. The Claims Comply with 35 U.S.C. § 112, ¶ 1 and 35 U.S.C. § 251

Claims 27-29 and 31-34 stand rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention. Claims 27-29 and 31-33 stand rejected under 35 U.S.C. § 251 as being based upon new matter added to the patent for which reissue is sought. The Examiner alleges that the use of the term “tensile” stress in claim 27 introduces new matter because the specification only uses the terms “intrinsic” stress and “compressive” stress.

Applicants respectfully submit that the disclosure of the present application clearly teaches the addition of a flow of a halogen source to a selected process gas at a flow rate to achieve a desired tensile stress in the layer from a plasma enhanced reaction of the selected process gas and the flow of the halogen source at the flow rate instead of a compressive stress in another layer formed from another plasma enhanced reaction of the selected process gas without the flow of the halogen source. The specification discusses the presence of compressive stress in the film. At page 14, lines 28-30, the specification states that Fig. 13 shows a reduction of the magnitude of the stress (which is compressive) of about -1.25×10^9 dyne/cm² at zero C₂F₆ flow, with higher C₂F₆ flow rates. As shown in Fig. 13, the stress changes from negative (i.e., compressive) to positive (i.e., tensile) at about 450 sccm C₂F₆ flow rate. See Declaration of Musaka, at ¶ 6.

It has been long held that “*ipsis verbis*” disclosure is not necessary to satisfy the written description requirement of section 112. Instead, the disclosure need only reasonably convey to persons skilled in the art that the inventor had possession of the subject matter in question.” *Fujikawa v. Wattanasin*, 39 U.S.P.Q.2d 1895, 1904 (Fed. Cir. 1996) (citation omitted); *In re Alton*, 37 U.S.P.Q.2d 1578, 1584 (Fed. Cir. 1996). The disclosure of the tensile stress is clear to a person of ordinary skill in the art. Disclosure of the tensile stress in the form of Fig. 13 is adequate. Thus, the claims comply with 35 U.S.C. § 112. Because the change of

the stress from compressive to tensile by introducing adequate flow of halogen source is clearly disclosed, the claims do not introduce new matter.

The Examiner continues to focus on her unfounded belief that it is impossible for the stress to change from compressive to tensile. This leads her to disregard the Declaration of Musaka who had over 13 years of industry experience and was involved in the experiments that led to the results presented in this application. Furthermore, the Examiner's belief also leads her to mischaracterize the disclosure, for instance, at page 8, line 21, to page 9, line 3. Claim 31 recites that the tensile stress is less than about 0.4×10^9 dynes/cm² in magnitude. This is shown in Fig. 13 where the positive (i.e., tensile) stress is less than about 0.4×10^9 dynes/cm² in magnitude. The compressive (i.e., negative) stress has a maximum magnitude of about 1.25×10^9 dynes/cm² in Fig. 13. Thus, the Examiner's statement that all values on Fig. 13 are below 0.4×10^9 dynes/cm² in magnitude is erroneous.

For at least the foregoing reasons, Applicants believe the claims comply with 35 U.S.C. § 112, and do not introduce new matter under 35 U.S.C. § 251.

C. Homma Does Not Anticipate or Render Obvious Claims 27, 28, or 31

The Examiner alleges that claims 27, 28, and 31 are anticipated or unpatentable over Homma, but Homma does not disclose or suggest adding a flow of a halogen source to the selected process gas at a flow rate previously determined to achieve a desired stress in the layer which is a tensile stress instead of a compressive stress in another layer formed without the flow of the halogen source. In contrast, Homma discloses that the addition fluorine reduces the magnitude of the tensile stress from a strong tensile stress for the prior art silicon oxide film of 1×10^9 dyn/cm² to a weaker tensile stress for the fluorine-containing silicon oxide film of 2×10^8 dyn/cm² (col. 3, lines 42-45).

D. Nishiyama et al. Does Not Render Obvious Claims 1-10, 27-29, or 31-34

Applicants respectfully submit that claims 1-10 are patentable over Nishiyama et al. because, for instance, Nishiyama et al. does not teach or suggest forming a layer using a gas comprising tetraethylorthosilicate and a gas selected from the group consisting of CY₄ and CX₃-(CX₂)_n-CX₃, wherein X is hydrogen or halogen and n is an integer from 0 to 5 with the proviso that at least one X is fluorine, and wherein Y is hydrogen or halogen and at least one Y is hydrogen and at least one Y is fluorine. Nishiyama et al. discloses CF₄, ClF₃, or SiF₄, and is

devoid of any suggestion for the recited compounds. The rejection relies on the benefit of hindsight.

Applicants respectfully contend that claims 27-29 and 31-34 are patentable over Nishiyama et al. because, for instance, it does not disclose or suggest adding a flow of a halogen source to the selected process gas at a flow rate previously determined to achieve a desired stress in the layer which is a tensile stress instead of a compressive stress in another layer formed without the flow of the halogen source.

The Examiner alleges at page 17, line 21 that Applicants ignored "the C₂F₂ teachings in Nishiyama et al." There appears to be no teaching of C₂F₂ in Nishiyama et al. Even if there were such teaching, it still would not have motivated a person of ordinary skill in the art to develop the formula for the fluorocarbon as recited in the claimed invention.

E. Weise Does Not Render Obvious Claims 27-29 or 31-34

Applicants respectfully contend that claims 27-29 and 31-34 are patentable over Weise because, for instance, it does not disclose or suggest adding a flow of a halogen source to the selected process gas at a flow rate previously determined to achieve a desired stress in the layer which is a tensile stress instead of a compressive stress in another layer formed without the flow of the halogen source.

The Examiner raises an inherency argument in connection with this rejection for the first time at page 14, line 20, to page 15, line 3. The Examiner alleges that the parameters of flow rate and reactant ratio are inherently related, but does not establish how it renders obvious adding a flow of a halogen source to the selected process gas at a flow rate previously determined to achieve a desired stress in the layer which is a tensile stress instead of a compressive stress in another layer formed without the flow of the halogen source.

In addition, an inherent feature may be relied upon to establish a rejection under 35 U.S.C. § 103(a), but only if such inherency would have been obvious to one of ordinary skill in the art. "That which may be inherent is not necessarily known." *In re Spormann*, 150 U.S.P.Q. 449, 452 (C.C.P.A. 1966). "Obviousness cannot be predicated on what is unknown." *Id.*

If the Examiner is alleging that the claimed feature is inherent, she must show that such inherency would have been obvious to one of ordinary skill in the art. The Examiner

has not made such a showing. Indeed, the references are completely silent as to adding a flow of a halogen source to the selected process gas at a flow rate previously determined to achieve a desired stress in the layer which is a tensile stress instead of a compressive stress in another layer formed without the flow of the halogen source.

As the court stated, “the inherency of an advantage and its obviousness are entirely different questions.” *Spormann*, 150 U.S.P.Q. at 452 (emphasis added). Further, “a retrospective view of inherency is not a substitute for some teaching or suggestion” in the prior art. *In re Newell*, 13 U.S.P.Q.2d 1248, 1250 (Fed. Cir. 1989). In this case, Weise contains no teaching or suggestion for the recited features. Accordingly, Applicants respectfully submit that the Examiner has failed to establish obviousness by inherency.

X. CONCLUSION:

In view of the foregoing arguments distinguishing claims 1-10, 27-29, and 31-34 over the art of record, Applicants respectfully submit that the claims are in condition for allowance.

Respectfully submitted,



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